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IDENTIFYING FACTORS IMPACT ON INVESTMENT IN FINANCIAL SERVICES UNDER DIGITAL FINANCIAL ECOSYSTEM TRANSFORMATION

The object of research is global investment processes in the financial services sector. The problem is the gaps in the development of analytical tools for assessing and forecasting the volume of global investments in the financial services sector when the role of financial institutions changes in the digital transformation of the financial ecosystem.

Correlation-regression analysis methods serve as the methodological basis of this research, implemented on the basis of Oxford Economics statistical data. A theoretical analysis of scientific approaches has been conducted to identify potential key factors influencing investments in financial services. A sample of statistical data on the dynamics of the international capital market has been formulated, characterizing changes in indicators of the financial services sector for the period 2004–2024. A correlation analysis has been conducted to identify multicollinearity of the identified factors and the resulting indicator – investments in financial services to assess their density and direction of the relationship. As a result of modeling, a regression equation with high reliability has been obtained. The model showed that gross output (X_1) acts as a dominant positive driver of investment activity. In turn, the most significant result is the detection of a statistically significant negative impact of the share of the financial sector in GDP (X_4) on total investment in the sector. The main forecast scenarios of the dynamics of global investments in financial services are formulated. The multidirectional impact on the dynamics of investment processes is determined – scale and structural balance within the integrated model. The practical result of its implementation is the application of the proposed toolkit for making investment and regulatory decisions in the medium term by investment funds, fintech companies and financial market regulators.

Keywords: *finance, financial ecosystem, financial services, investments, financial technologies, digital transformation, modeling.*

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1. Introduction

The transformation of the financial services market in the context of digitalization is seen as a transition from traditional models of financial intermediation to technology-oriented financial ecosystems. This becomes the basis for changing the role of financial institutions in providing digital financial services and is characterized by a significant reduction in transaction costs.

The financial services sector, thanks to the rapid introduction of the results of scientific and technological progress, is transforming into a dynamic financial ecosystem with complex relationships and interdependencies. This significantly changes its role – a simple financial intermediary and significantly expands the range of opportunities for economic growth.

The introduction of new digital financial technologies, such as blockchain, embedded payments, asset tokenization, is fundamentally changing the functioning of the financial services market and forming a digital financial ecosystem. As a result, the digital financial ecosystem is a multi-level and distributed networked open socio-technological system based on digital platforms and technologies for the interaction of financial entities to create digital financial services (products) by transforming and redistributing financial resources based on the digital financial infrastructure and institutional rules for the interaction of financial market actors, which ensures effective risk management in order to maintain financial stability and inclusion.

The definitions of innovation have become not only the basis for increasing the efficiency of financial institutions and reducing the cost of providing financial services and their inclusion, but also have identified new challenges and risks. This requires a new critical approach to identifying key factors influencing investments in financial services for making decisions in the field of capital management.

The financial services sector has always been distinguished by increased profitability and return on capital, which attracts the attention of investors and makes the analysis of investment processes relevant.

Instead, statistical studies show a trend of decreasing global investments in the fintech sector. Thus, in the first 3 months of 2024, global financing of the fintech sector decreased by 16% and amounted to 7.3 billion USD. This is the lowest level since 2017. The indicators show an alarming contrast with the first quarters of the previous 2 years: in 2023, financing in the amount of 16 billion USD was directed to 1271 fintech startups; in 2022 – 32.9 billion USD to 2026 fintech startups [1].

The trend of cooling of investors' attention to the sector coincides with the increase in risks and cybersecurity threats in the financial sector.

According to Immunefi research, in the first 3 months of 2024, the crypto industry lost 336.3 million USD due to hacker attacks and fraud. Despite the fact that the number of attacks decreased by 17.6% and losses by 23.1%, compared to the same period in 2023, the volume of losses remains quite high [2].

On a global scale, the problems of finding a balance between the rapid development in the field of implementing digital financial technologies and the risks and threats caused by cyber fraud determine new challenges when investing in the financial services market. This necessitates the search for new tools based on identifying factors influencing investments in financial services in order to predict their changes in the conditions of digital transformation of the financial ecosystem.

Given that the financial services market is rapidly developing under the influence of new technological changes and, in general, quite a few scientists are engaged in certain issues of investment in the financial sector and the development of the financial services market, an analysis of scientific and practical literature was conducted.

Thus, in the work [3] a number of strategies are considered aimed at resolving the complex relationship between financial regulation and data management, which is part of the construction of open finance. Some researchers are looking for a balance using the information theory of financial intermediation [4]. For innovation and inclusion, the creation of an ecosystem in the field of digital finance is traced. Such an ecosystem is aimed at stimulating innovation in both the supply and demand sectors, as well as strengthening such key factors as regulation, policy, infrastructure and technology [5].

The risks and factors that determine changes in investments in the cryptocurrency market, as well as the prospects for regulating this market in Ukraine, are investigated in [6]. In [7], the feasibility of investing in US bank stocks for minority investors with speculative, rather than long-term, intentions is proven. It was determined that the fintech payment sector has the highest investment activity, and there is an increase in investor interest in the following sectors: cybersecurity, regulatory technologies, cryptocurrency and blockchain [8]. Of particular note is the statement in [9] that the demand for additional resources is especially strong during the technical re-equipment of the economy, which requires large investments and increases the role of non-bank financial institutions in ensuring constant financing of certain sectors of the economy.

In [10], an analysis of the influence of the role of alumni relations in the formation of investment decisions by endowments of US universities is carried out. Investor diversity has a positive impact on loan liquidity: more diverse syndicates, measured by the number of investor types or the concentration of loan shares by investor type, have loans with lower bid-ask spreads in the secondary market [11].

To increase investment attractiveness, [12] proposes the implementation of a Zero Trust Architecture platform, which allows financial institutions to significantly enhance the protection of cross-border transactions and digital wallets, while demonstrating compliance with regulatory requirements in different jurisdictions. The financial sector is undergoing a profound digital transformation driven by technologies (e. g., blockchain and AI) aimed at increasing efficiency and accessibility, but which requires addressing critical issues such as privacy, security, and regulatory barriers, while increasing competition from non-financial fintech startups significantly increases the innovative activity (measured by patent applications) of existing financial companies [13, 14].

The paper [15] provides a ranking of national markets for investment financial services into three clusters:

1) markets with a high level of openness;
2) markets with a medium level of openness;
3) markets with a low level of openness.

A methodological approach to assessing the openness of the investment financial services market is considered. This involves distinguishing markets with a net inflow of investment resources, markets with a net outflow of investment resources, and markets with a balanced movement of investment resources. And, as a result, the average volume of portfolio investments in securities issued by non-residents was determined.

In [16], one of the approaches to forecasting the volume of investments is presented, which is based on the use of the established statistical dependence of gross investments on the export of goods (goods and services). In addition, the angle of inclination of this dependence determines the degree of influence of stability in world markets on the country's economic growth. Exports of goods (goods and services) are defined as a function of world prices for the main exported goods. Using the proposed approach to determine investments in the forecast period will allow calculating the marginal propensity to invest in the Keynesian investment formula, which is used in constructing the IS-LM aggregate demand function model according to the Hicks-Hansen principle.

In [17], it was investigated using correlation-regression analysis that the volume of venture capital investments in FinTech projects and the FinTech market development rating have the greatest impact on foreign direct investment among the main factors characterizing the development of FinTech in the country. This proves the positive impact of FinTech companies on the growth of foreign investment in the country.

The study [18], which analyzed portfolio investments, is meaningful. It concluded that it did not find empirical confirmation of the hypothesis about the dependence of the size and directions of portfolio investments on the size and level of economic development. Developed countries are present in approximately the same proportions among both recipient leaders and investor leaders. This gives grounds to argue that belonging to a particular group is determined by the economic model chosen by a particular country. It is also possible to suggest that net portfolio investments are to some extent influenced by the state of the country's trade and balance of payments. However, this position requires additional argumentation and empirical verification, which may be the goal of subsequent studies. For a number of countries, there is a significant correlation between net portfolio investments and economic growth rates. More often, such a relationship has an inverse relationship for the current year. However, cases of direct dependence have also been identified (especially when the economic growth rate shifts by one year). Such multivariate directions of dependence can be explained by the multifactorial interaction of investment and economic growth. A number of factors have opposite directions of influence. Since they all act simultaneously, the actual direction of the relationship between the studied indicators will be determined by the ratio of the strength of these factors [18].

Recent developments in the field of FinTech research have significantly expanded our understanding of how technological innovations change the competitive dynamics in financial services markets. The work [19] provides a fundamental understanding of the mechanisms by which FinTech lending platforms disrupt traditional competition in the credit market, demonstrating that digital lending technologies create both substitution and additional effects compared to traditional banking services.

Finance, data and technology are now interconnected as a result of the long-term process of digitalization of finance in both developed and emerging markets. In [20], the thesis is proven that regulatory consequences for fintech innovations interact with each other and, thereby, have a powerful impact on the formation of market structure, competitive dynamics and investor confidence. It is emphasized that this connection between technological and regulatory factors creates both opportunities and risks that significantly affect the processes of making investment decisions.

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The main goal of the study [21] is to determine the role of cultural acceptability as a mitigating factor in the formation of the relationship between the competitiveness of fintech solutions and both the implementation of fintech solutions and customer trust.

The analyzed studies of scientists consider the impact of a wide variety of factors on both the digital financial ecosystem as a whole and financial services in particular. These include the role of cultural acceptability and trust, competitiveness, multifactorial impact, clustering of financial services markets with the allocation and assessment of determinants, cybersecurity and privacy. However, the issue of studying investments in financial services, taking into account the definition of deterministic factors and their impact in the context of the transformation of the digital financial ecosystem as a whole, has not been given sufficient attention.

Also, there are gaps in the development of analytical tools for assessing and forecasting the volume of global investments in the financial services sector when the role of financial institutions changes in the context of the digital transformation of the financial ecosystem.

Thus, taking into account the literature review conducted, the issue of analytical assessment of factors influencing investment processes in the financial services market and identifying their patterns is relevant for research.

The object of research is global investment processes in the financial services sector.

The aim of research is to identify key factors influencing the volume of global investments in the financial services sector and identify patterns of their change in the context of the digital transformation of the financial ecosystem to develop analytical tools for assessing and forecasting investment flows based on a scenario approach.

To achieve the aim, the following objectives were solved:

1) at the theoretical level, to determine the main factors influencing investment processes in the financial services market and to form a sample of statistical data characterizing the dynamics of its main indicators for the period 2004–2024;

2) to conduct a correlation analysis to identify multicollinearity of the identified factors and the resulting indicator – investments in financial services to assess their density and direction of the relationship;

3) to select the most significant factors, to form and substantiate hypotheses that become the basis for building regression models that quantitatively describe their cumulative impact;

4) to form the main forecast scenarios for the dynamics of investments in financial services.

2. Materials and Methods

The presented research used methods of economic and statistical analysis, namely correlation and regression analysis, which allows to establish quantitative relationships between variables.

The empirical basis of research was annual statistical data characterizing the global financial services sector for the period 2004–2024. Statistical information was obtained from the Oxford Economics database (Industry Forecast Date) and additional data from the Emis platform.

As a result indicator, (Y) was defined – investment in financial services (dependent variable). As initial factor indicators (independent variables – X): gross output (X_1), value added index (X_2), value added volume (X_3), output from real GDP as a percentage (X_4), gross operating profit (X_5).

Data processing and analysis were carried out using the Microsoft Excel software package and its built-in tool "Data Analysis/Regression", as well as Origin software for scenario analysis. The analytical process was carried out in several stages.

First, correlation analysis was used to assess the strength of the relationship between all variables interpreted according to the Chaddock scale, which allowed to identify the presence of multicollinearity, which allowed to exclude some factors from further analysis. Subsequently, hypotheses were formulated and proven based on regression analysis and the construction of one-factor and two-factor linear models, which included factors with the lowest mutual correlation.

The statistical significance of the resulting model was checked using standard criteria: the coefficient of determination (R-squared), Fisher's F-test, and Student's t-statistics.

3. Results and Discussion

The financial services market is one of the most important and influential sectors of the economy, which includes a wide range of certain activities, such as banking, investment and insurance.

Advantages of investing in the financial services sector [22, 23]:

1. The financial sector is considered a reliable investment area that provides stable long-term income. Over the past 30 years, the income of the financial sector has grown faster than the economy as a whole. Financial companies are usually subject to close supervision by market regulators, and investments in many well-known financial and credit organizations can bring stable dividends higher than the market average.

2. When interest rates rise, financial and credit institutions, their investors and subcontractors increase their income.

3. The state of the financial sector directly affects the economy, so during periods of recessions and financial crises, actors in this market receive special support from the authorities.

4. The financial sector receives additional benefits from the implementation of innovative technologies such as mobile payment applications, blockchain, robo-consultants and others, which stimulates further growth of the sector.

Disadvantages and risks of investments in the financial sector [22, 23]:

1. The financial business usually does not provide for a high rate of return on unit services, therefore, the high margin of financial institutions is associated with the use of the effect of "scale", as a result, most actors in the financial sector are large companies.

2. The issue of the so-called "too big – to fail" effect deserves special attention, which requires special support from regulators for financial sector entities on the one hand. On the other hand, financial intermediation acts as a framework for ensuring the stability of transaction processes in the national economy, which also requires a special approach to ensuring their stability.

3. Strict regulatory requirements for the financial stability of financial sector institutions, aimed at increasing the security of its functioning, significantly affect their profitability.

4. Fintech innovations introduced by startups in this area, in the context of digitalization, are rapidly spreading to the entire financial market, which reduces the marginality of traditional financial institutions and adds additional risks to the sustainability of their business model in the medium term, which reduces the income of institutional investors.

5. The financial sector is highly dependent on political events and conditions, certain statements by official government representatives, which creates additional risks and increases the volatility of the market as a whole.

An analytical assessment of global investments in financial services based on a sample of indicators for the period 2004–2024 according to Oxford Economics – Industry Forecast Data, EMIS [24] allowed to identify the following indicators (factors) of the functioning of the financial services market:

Y – total global investments in the financial services sector, real (billions of USD in 2015 prices) – the resulting indicator;

X_1 – total global gross output (financial services), in real USD (billions of USD in 2015 prices);

X_2 – value added index (financial services), % 2015 = 100%;

X_3 – the volume of total global value added created by the financial services industry during the year, in real USD (billions of USD in 2015 prices);

X_4 – output from real GDP, %;

X_5 – aggregate global gross operating profit (financial services), nominal (billions of USD in 2015 prices).

The input data for the correlation-regression analysis are presented in Table 1.

Based on the initial data in Table 1, a correlation matrix was created to determine the degree of relationship between the selected factors and the performance indicator using Microsoft Excel. The results are shown in Table 2.

The assessment of the connection degree between the studied parameters was carried out using the Chaddock scale; the details of this assessment are presented in Table 3.

Since there is multicollinearity between the performance indicator (investment in financial services) and factors X_2 and X_3 (value added index and value added volume), it is advisable to exclude the latter from the model. There is a weak correlation between factors X_4 and the performance variable Y – 0.423, but this indicator is used in the future to consider hypotheses.

Based on the initial data for factors X_1, X_4 and X_5, a correlation matrix was created to determine the degree of relationship between them and the performance indicator using Microsoft Excel. The results obtained are shown in Table 4.

To study the relationship between factors and investment in the financial services sector, hypotheses were tested. To test the hypotheses, an analysis of various models was conducted. There are various linear and nonlinear models, for example, based on nuclear methods or Markov chains [25, 26]. There is multicollinearity between the indicators X_1 and X_5, which is quite logical and requires studying their impact on investment in financial services separately based on single-factor models, and, subsequently, a two-factor model is formed. In this work, linear regression models were chosen for forecasting.

Table 1

Input data for the correlation-regression analysis of investments in financial services

Indicator/ years	Gross output (financial services)	Value added index (financial services)	Value added volume (financial services)	Output from real GDP (financial services)	Gross operating profit (financial services)	Investment in financial services, real
	X_1	X_2	X_3	X_4	X_5	Y
2004	28386.05	69.55	12264.43	24.36	5734.66	4247.78
2005	29690.43	73.06	12883.99	24.63	6207.86	4460.53
2006	31062.07	76.35	13463.63	24.69	6619.05	4631.26
2007	32605.06	80.65	14222.28	25.03	7478.19	4735.49
2008	32977.54	82.14	14485.63	24.97	7991.41	4642.37
2009	32999.14	82.92	14622.49	25.58	7894.80	4181.99
2010	34109.18	85.39	15058.22	25.25	8312.06	4356.40
2011	35304.38	88.28	15568.71	25.23	8969.96	4627.30
2012	36312.15	91.49	16134.07	25.44	9054.12	4871.42
2013	37567.80	93.91	16560.58	25.42	9482.14	5051.33
2014	38669.29	96.86	17081.61	25.43	10050.78	5145.27
2015	40200.67	100.00	17635.06	25.47	9884.36	5178.92
2016	41355.60	102.59	18091.70	25.44	10275.48	5364.31
2017	43206.20	105.60	18621.82	25.30	10669.67	5570.00
2018	44063.80	108.89	19202.23	25.24	11245.18	5764.55
2019	45727.30	111.98	19748.02	25.29	11321.95	5947.47
2020	45805.70	111.20	19609.70	25.91	11501.39	5834.03
2021	48045.50	116.85	20605.73	25.66	12431.91	6021.18
2022	49203.50	119.47	21068.21	25.44	12362.54	6218.81
2023	50079.60	121.93	21503.12	25.19	13127.75	6373.23
2024	51369.50	125.47	22126.15	25.12	14164.84	6559.00

Note: compiled by the author based on data [24]

Table 2

Results of correlation analysis of investments in financial services

Indicator	X_1	X_2	X_3	X_4	X_5	Y
X_1	1.000	–	–	–	–	–
X_2	0.998	1.000	–	–	–	–
X_3	0.998	1.000	1.000	–	–	–
X_4	0.568	0.593	0.593	1.000	–	–
X_5	0.988	0.993	0.993	0.602	1.000	–
Y	0.975	0.967	0.967	0.423	0.949	1.000

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Table 3

Characteristics of the connection closeness

Indicator	Gross output (financial services)	Value added index (financial services)	Volume of value added (financial services)	Output of real GDP (financial services)	Gross operating profit (financial services)
	X_1	X_2	X_3	X_4	X_5
Investments	Strong	Multicollinearity with X_1	Multicollinearity with X_1	Weak correlation between factor variable X_4 and outcome variable Y	Strong

Table 4

Results of correlation analysis of investment in financial services between variables X_1, X_4, X_5 and Y

Indicator	X_1	X_4	X_5	Y
X_1	1	–	–	–
X_4	0.56812	1	–	–
X_5	0.9877	0.6016	1	–
Y	0.97511	0.42285	0.94948	1

Based on the analysis, in particular on the selected variables and the results of the regression analysis, the following key research hypotheses can be formulated: null (H_0) and alternative (H_α).

The formation of hypotheses for this research is based on the assumption that investment activity has a close relationship with the general macroeconomic situation and operational activities in the sector.

Based on Hypothesis 1, one of the main drivers of investment is tested – the total economic activity of the sector, characterized by gross output – the total volume of goods and services produced, which is a key indicator of the development of the industry.

H_0 (Hypothesis 1) – about the absence of a statistically significant relationship between the volume of gross output in the financial services sector (X_1) and the performance indicator (Y), that is, the volume of investment in this sector.

H_a (Hypothesis 1) – about the existence of a statistically significant relationship between the volume of gross output in the financial services sector (X_1) and the performance indicator (Y). The growth of economic activity stimulates investment in the industry (Fig. 1).

Based on Hypothesis 2, profitability is tested, which acts as a direct source for reinvesting capital and attracts external investors.

H_0 (Hypothesis 2) – there is no statistically significant relationship between gross operating profit generated in the financial services sector (X_5) and the volume of investments. H_a (Hypothesis 2) – there is a statistically significant positive relationship between gross operating profit (X_5) and the volume of investments (Y), since higher profits increase the ability and willingness of companies to invest in development (Fig. 2).

Regarding the analysis of the inclusion of factors in the two-factor model, it is possible to conclude that the correlation coefficient between gross output (X_1) and profit (X_5) is 0.987, which indicates their almost linear relationship. Including both variables in one model would lead to distortion of estimates and a decrease in their reliability. Excluding profit from the final model is a methodologically correct decision and does not diminish its economic role. This means that the information carried by the profit indicator is already largely incorporated into a more general and comprehensive indicator of gross output. Therefore, the impact of profitability on investment in this model is realized indirectly through the main channel of economic activity.

The results of the correlation analysis of investment in financial services in Table 4 allow to conclude that it would be advisable to analyze the relationship between the factors X_1 and X_4, because they have the least multicollinearity in the analysis between these three factors.

Hypothesis 3 is more complex and tests whether the relative weight of the sector in the economy affects investment, while simultaneously taking into account the absolute size of the sector itself.

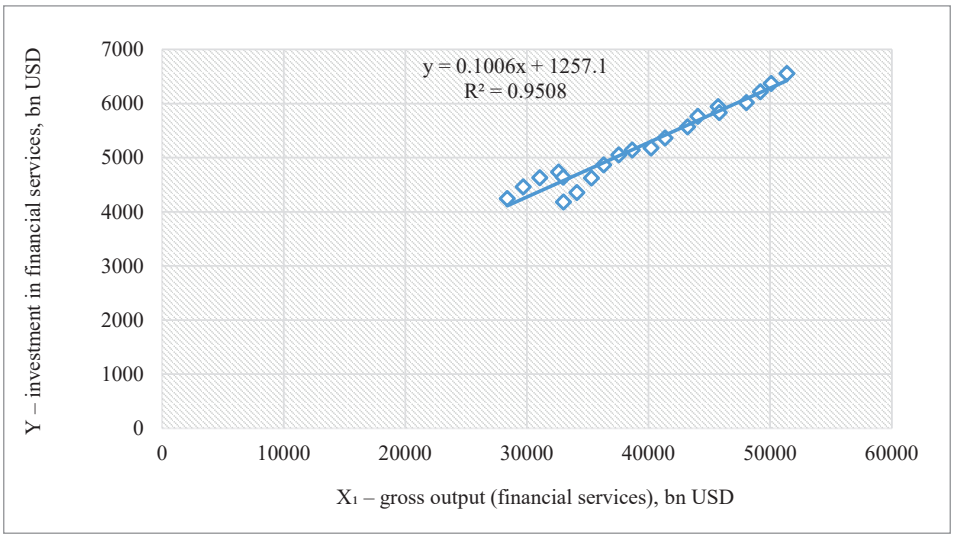

Fig. 1. Relationship between the flow of gross output (financial services) and investment in financial services

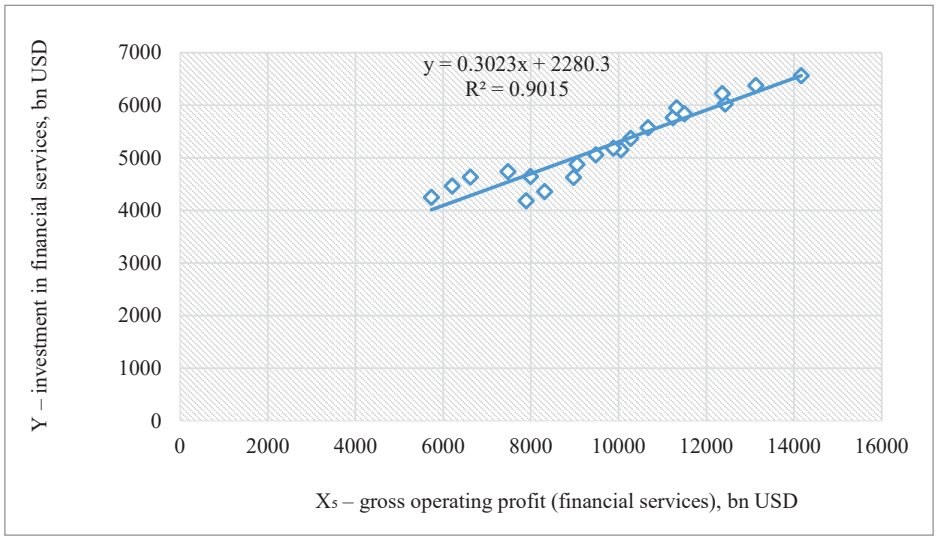

Fig. 2. Relationship of gross operating profit flow (financial services) to investment in the financial services sector

If the financial sector becomes too large relative to the rest of the economy, then a likely negative impact may indicate a dynamic reallocation of capital to other sectors.

H_0 (Hypothesis 3) is the prediction that the share of financial services sector output in real GDP (X_4) has no statistically significant impact on the volume of investment, taking into account other factors.

H_a (Hypothesis 3) is the prediction that there is a statistically significant negative impact of output in real GDP (X_4) on the volume of investment (Y), when taken into account in the multivariate model together with gross output.

The econometric modeling provided statistically reliable results of assessing the impact of key factors on the dynamics of investment in the financial services sector.

Hypothesis 1: Regarding the positive impact of gross output (X_1). The hypothesis Ha about the presence of a statistically significant positive relationship between gross output and investment volume is fully and convincingly confirmed.

Gross output (financial services) is an indicator of total economic activity in the production of new goods and services during the accounting period. It is a much broader indicator of the economy than gross domestic product (GDP), which is limited mainly to final products (finished goods and services). Economists consider gross output (GO) and GDP as additional indicators of aggregate economic activity. From an accounting point of view, GO is considered the "top line" in accounting for national income, and GDP is the "bottom line".

The analysis shows a direct impact of gross output (financial services) on investment in financial services, which is confirmed by statistically significant indicators, the normalized coefficient of determination R^2 is 0.9508. That is why, proving hypothesis 1 provides a lot of information for further planning of investments in financial services, especially against the background of threats of cyberattacks and fraud and a gradual decrease in financing.

However, the direct impact of gross output (GO) on investment can have a significant effect on economic activity. As a rule, a large amount of gross profit indicates a dynamic development of the economy and can stimulate investment. Because gross output can increase the income of enterprises and, as a result, their interest in investing in R&D. At the same time, an increase in the level of gross output can indicate a high demand for financial services.

Hypothesis 2: Hypothesis H_a about the positive effect of profit on investment is confirmed at the level of bivariate analysis, however, in the multivariate model this factor turns out to be statistically redundant due to the high degree of multicollinearity with gross output.

The high correlation coefficient between investment and gross operating profit ($r = 0.949$) and the significant coefficient of determination in the univariate model ($R^2 = 0.9015$) indicate that profitability is certainly an important incentive for investment. This is fully consistent with the classical theory of finance, according to which profit is the main source of internal capital for reinvestment (pecking order theory).

Investments in financial services can contribute to the development of new products and services, which can lead to an increase in gross operating profit due to increased sales or improved margins. The use of technology in financial services can lead to reduced transaction costs and increased business efficiency, which in turn can have a positive impact on gross operating profit. Investing in financial services, including Fintech, can also be associated with a certain level of risk.

Hypothesis 3: Regarding the negative impact of the sector's share in GDP (X_4).

Conclusion: Hypothesis Ha about the presence of a statistically significant negative impact of the financial sector's share in GDP on investment (taking into account gross output) is convincingly confirmed and is the most significant and non-trivial result of the study.

To determine the form of the relationship between the studied parameters, a regression analysis was conducted using MS Excel (under the "Data Analysis/Regression" menu). The results obtained are presented in Tables 5–7.

Table 5

Main regression indicators

Multiple *R*	0.988045719
R-squared	0.976234342
Normalized *R*-squared	0.973593714
Standard error	119.832333
Observation	21

Table 6

Results of analysis of variance

Indicator	Df	SS	MS	F*	Significance F
Regression	2	10617561.26	5308780.629	369.6977016	2.41851E-15
Remainder	18	258476.1845	14359.78803	–	–
Total	20	10876037.44	–	–	–

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Table 7

Results of regression analysis

Indicator	Coefficients	Standard error	*t*-statistic	*p*-value
Y – Investment	10861.61014	2195.19853	4.947894232	0.000103938
X_1 – Gross output	0.111965454	0.004555909	24.57587478	2.67616E-15
X_4 – Output from real GDP	–398.2370437	90.8074246	–4.385511928	0.000356715

The coefficient (–398.23) obtained in the multivariate model for the variable X_4 is statistically highly significant (p-value ≈ 0.00036). This result reveals the complex, nonlinear nature of investment processes. The model actually separates two effects: the scale effect (positively reflected in gross output) and the saturation or systemic risk effect (negatively reflected in the share of the sector in the economy). Thus, from this study, it is possible to draw a preliminary conclusion about a direct stochastic relationship between gross output, output from real GDP as a percentage, and investment.

Based on the results of the regression analysis, the multiple regression equation has the form

$$Y = 10861.61 + 0.11 \cdot X_1 - 398.23 \cdot X_4, \quad (1)$$

where Y – the projected volume of investment in financial services (billion USD);

X_1 – gross output in the financial sector (billion USD);

X_4 – share of the financial sector in GDP (%).

So, from the above study, it is possible to conclude that there is a direct relationship between gross output, output from real GDP in percent and investment in financial services. For example, if gross output (X_1) increases by one unit, then investment will increase by 0.1; if output from real GDP (X_4) increases by one unit, net income will decrease by 398.23.

That is, the impact of gross output on investment in financial services can be significant and dynamic. This relationship can stimulate the scaling of the capital market, which can positively affect the increase in the availability of attracting investments in the financial services sector.

As the research results showed, a high level of gross output can contribute to the development of investment activity in the financial services sector. This pattern is also based on the development of technological infrastructure in the financial sector, which includes digital banking, embedded finance, asset tokenization, digital risk management tools, etc. Therefore, the growth of gross output can directly increase the volume of investment in financial innovative products.

The economic interpretation of the proposed model shows that the growth of investment activity occurs when the financial sector develops in a balanced way in the real economy.

However, if growth is ahead and its share in GDP increases, this can lead to the formation of a "financial bubble", excessive "financialization" of the economy as a whole and the depletion of productive investment niches. In such a situation, the return on capital from new investments can decrease, and systemic risks can increase, which forces investors to take into account external factors and reduce capital investments. Thus, the model empirically proves the existence of an optimal balance between the real economy and the size of the financial services sector. The departure from this balance creates the prerequisites for a decrease in investment activity, even with the growth of the financial services sector.

The forecast of investment in financial services according to the scenarios is based on the econometric regression model (1), built on the basis of historical observation data for the period 2004–2024. Model (1) of hypothesis 3 shows the stability of regression coefficients, which confirms its predictive significance in the conditions of the digital transformation of the financial sector.

To form an optimistic scenario, an assumption of stable growth of gross output *X1* at the level of 3.8% per year was made, which reflects the relationship between the dynamic development of the economy and the increase in the scale of financial services. At the same time, a gradual decrease in the share of the financial sector in GDP by 0.28 percentage points per year is assumed, which indicates a possible outpacing growth of the real sector of the economy compared to the financial services sector.

The basis for extrapolation is the statistical data of the sample for 2004–2024 (Table 1). The forecast for the next 2025–2028 is calculated using the obtained regression equation (1) taking into account the specified growth rates and changes in structural indicators. This approach allows to quantitatively assess the potential for growth in investment volumes in the financial sector under conditions of optimistic macroeconomic market conditions in the context of the transformation of the digital financial ecosystem.

The modeling results reflect a gradual increase in investment flows, which in 2028 reach 7,983 billion USD, which is 21.7% higher than the level in 2024 and demonstrates the stability of the financial sector during the period of active digital transformation of the global financial ecosystem.

The forecast graph of the dynamics of global investment in financial services under optimistic, baseline and pessimistic scenarios shows the dynamics of historical investment indicators for 2004–2024 (black solid line) and three alternative scenarios (forecasts for 2025–2028) (Fig. 3).

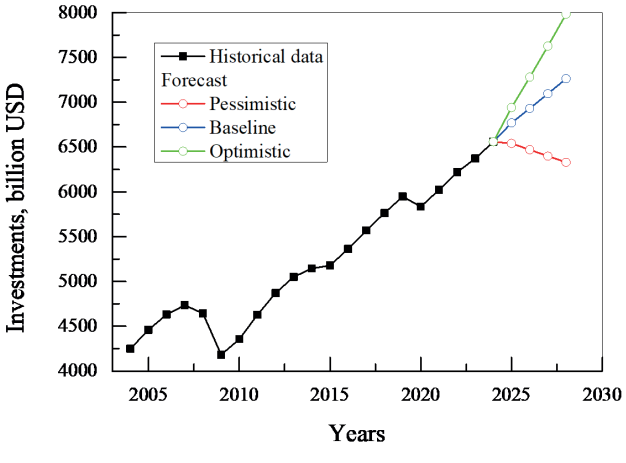

Fig. 3. Forecasting the dynamics of global investment in financial services under optimistic, baseline and pessimistic scenarios (2025–2028)

The pessimistic scenario (red dotted line) shows a slight decrease in investment to 6,329 billion USD with a slowdown in growth.

The baseline scenario (blue dotted line) demonstrates stable moderate growth with a projected increase of 7,292 billion USD.

The optimistic scenario (green dotted line) illustrates a significant increase in investment to 7,983 billion USD, which corresponds to the improvement of macroeconomic conditions and technological development in the context of the rapid transformation of the digital financial ecosystem.

The research result is empirical confirmation of the influence of the dominant role of gross output as a predictor of investment in financial services. This conclusion has a deep theoretical significance, which, unlike previous studies, provides an opportunity to cover the full range of financial and economic activity, which is especially relevant for a sector with such broad technologically interconnected features.

The proposed approach can be partially found in the work [16], which searched for operational drivers for investment (driver – exports), not limited to general indicators of economic growth. Instead, the result of the presented research demonstrates that intra-industry dynamics are a more powerful explanatory factor for investment in the financial services sector than external factors.

The most significant is the second research result – the presence of a statistically significant dense negative impact of the share of the financial sector in GDP and investment in terms of increasing gross output, which provides evidence of the existence of the so-called effect of "excessive financialization" or "market maturity".

The developed model quantitatively demonstrates the existence of a certain saturation point, after which further expansion of the relative weight of the financial sector in the global economy begins to be associated with a decrease, rather than an increase, in investments even in conditions of increased return on capital.

In work [18], no direct relationship was found between the size of the economy and the direction of portfolio investments, instead, the model proposed in this work assumes that what is important is not the absolute size, but the structural balance between the financial and real sectors.

At the same time, the research creates a macroeconomic basis for studies that analyze more specific factors, for example, in work [17] the positive impact of the development of financial technologies on foreign direct investments was proven. The proposed model shows the balanced nature of the financial sector, which can create more favorable or unfavorable conditions for the creation of innovative startup projects.

The practical significance of the results lies in the possibility of using the model for medium-term forecasting (2025–2028) with an expectation range from 6,329 billion USD (pessimistic scenario) to 7,983 billion USD (optimistic scenario).

The toolkit can be useful for regulatory authorities, fintech companies, investment funds, and individual investors and analysts to make informed financial decisions.

The results obtained confirm the hypotheses about the transformation of traditional dependencies in the context of restructuring the financial ecosystem and create a theoretical and methodological basis for further research into investment processes.

A limitation of research is the use of aggregated global data, which are retrospective in nature and do not allow for taking into account clustering in individual regions. Also, the limitations of this research may be the factors of influence of geopolitical risks, regulatory changes, and cyclical technological innovations, which may generally affect the accuracy of long-term forecasts.

Possible directions for the development of the research are related to the expansion of the factors influencing the model by including variables characterizing the financial innovation index and cybersecurity indicators. It may also be advisable to use Data Mining and Machine Learning approaches to take into account complex relationships in the context of the transformation of digital financial ecosystems.

4. Conclusions

1. Based on a thorough theoretical analysis of modern scientific and practical approaches, the key factors influencing investments in financial services in the context of digital transformation were identified. A sample of indicators for the period 2004–2024 was formed, ensuring the representativeness of the statistical analysis, and the use of the Oxford Economics and Emis databases made it possible to quantitatively assess the dynamics of the industry and obtain comparative assessments of the effectiveness of investment processes in the financial services industry.

2. Based on correlation analysis, it was possible not only to quantitatively assess the impact of key determinants in the financial services industry, but also to identify the complex, nonlinear nature of investment processes in the context of the transformation of the financial ecosystem. A significant result was the empirical confirmation that gross output (financial services) is the dominant positive driver of investment, emphasizing that it is the scale of operating activities that is a prerequisite for capital investments.

3. An integrated regression model with high forecast accuracy ($R^2 = 0.976$) $Y = 10861.61 + 0.11 \cdot X_1 - 398.23 \cdot X_4$ has been developed, which quantifies the impact of gross output of financial services and their share in GDP on investment flows in the industry. A paradoxical negative effect of economic financialization on investment activity with an elasticity of –1.879 has been traced, which contradicts traditional ideas about a linear relationship between factors of financial sector development and investment in it.

A synergistic analysis of two different effects, such as the scale effect (positive effect) and the structural balance effect (negative effect) within a single model indicates empirical confirmation of the effect of "excessive financialization". This resolves the issue of the inadequacy of traditional linear approaches and demonstrates that the outstripping growth of the financial sector relative to the real economy restrains capital investment.

4. Forecasting the dynamics of global investments in financial services under optimistic, baseline and pessimistic scenarios (2025–2028). The methodological contribution of research is realized through the use of scenario analysis with differentiation of pessimistic (growth by 0.5% annually), baseline (2.2% annually) and optimistic (3.8% annually) development scenarios based on empirical data.

Conflict of interest

The authors declare that they have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

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The research was performed without financial support.

Data availability

The manuscript has no associated data.

Use of artificial intelligence

The authors confirm that they did not use artificial intelligence technologies in creating the submitted work.

Authors' contributions

Oleksandr Manoylenko: Methodology, Validation, Investigation, Resources, Data curation, Writing – original draft, Writing – review and editing, Visualization, Supervision, Project administration, Funding acquisition; ***Svitlana Kuznetsova***: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Writing – review and editing, Supervision, Project administration, Funding acquisition.

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